DOCUMENT RESUME

ED 056 650 HE 002 649

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TITLE College Educated Workers, 1968-80; A Study of Supply and Demand.
INSTITUTION Bureau of Labor Statistics (DOL), Washington, D.C.
REPORT NO Bull-1676
PUB DATE 70
NOTE 28p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *College Graduates; Employment Projections; Higher Education; *Junior Colleges; *Labor Supply; *Manpower Needs; *Professional Occupations; Subprofessionals; Working Women

ABSTRACT

This report analyzes the expected demand and supply for college graduates through the 1970's. It is based on the assumption that current supply patterns will continue and that there will be full employment and an improved international climate. The report reviews the supply and demand for workers with bachelor's and advanced degrees, as well as specific supply-demand situations for selected occupations that generally require a bachelor's or advanced degree for entry. The report also reviews the supply and demand for junior college trained manpower and for selected occupations requiring junior college training for entry. As part of these reviews, a special section is devoted to the outlook for college-educated women. (AF)

ED056650

# College Educated Workers, 1968-80

## A Study of Supply and Demand

BULLETIN 1676

U.S. DEPARTMENT OF LABOR
J. D. Hodgson, Secretary

BUREAU OF LABOR STATISTICS
Geoffrey H. Moore, Commissioner

1970

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# COLLEGE EDUCATED WORKERS, 1968-80

## A Study of Supply and Demand*

*Introduction.* This bulletin analyzes the expected supply and demand for college graduates through the 1970's. It presents a review of the manpower situation for all college graduates as well as for selected individual occupational fields. Also presented are separate discussions of two subjects of special interest—(1) the outlook for college educated women and (2) the effect of the rapid expansion of junior colleges on the supply of college trained manpower. This information was requested by the House Subcommittee on Higher Education for use as a background document for evaluating proposed legislation.

Supply and demand in this bulletin are not discussed in the usual economic sense in which wages play a major role in equating supply with demand. The long training period required to enter professional and technical occupations prohibits the immediate adjustments normally associated with the terms supply and demand.

Supply represents estimates of the numbers of workers who may enter a particular occupation if past trends of entry to the occupation were to continue. Demand represents estimates of the number of workers who will be required to produce the amount of goods and services implied in the Bureau's basic model of the economy for 1980. Included are estimates of manpower needs resulting from growth and replacements due to deaths, retirements, and other separations from the labor force, and from transfers to other occupations.

*Highlights.* The supply and demand for college graduates as a whole is expected to be in relative balance during the 1970's. Nevertheless, imbalances may occur in many individual occupations if past study and work patterns continue.

Among individual fields, perhaps the most dramatic change is in elementary and secondary school teaching in which a more than adequate supply is expected.

For several specific occupations that were analyzed, projected growth and prospective supply-demand relationships if study and work patterns were to continue are shown in table 1.

Projections presented in this report, thus, are not attempts to forecast actual supply-demand conditions in the future. Rather, they indicate what conditions can be expected if current supply patterns continue. This analysis provides Congress and others concerned with educational planning information on prospective occupational imbalances so that informed decisions can be made to advert prospective supply-demand imbalances

*The bulletin was prepared in the Bureau of Labor Statistics, Division of Manpower and Occupational Outlook by, Neal H. Rosenthal with the assistance of Michael Crowley, Michael Pilot, and Joyce Kling.

**Table 1. Occupational employment, 1968 and projected requirements, 1980, for college graduates**

| Occupation | Estimated 1968 employment | Projected 1980 requirements | Percent change | Supply estimated to be |
|---|---|---|---|---|
| Chemists | 130,000 | 200,000 | 55.7 | Significantly below requirements |
| Counselors | 71,000 | 107,000 | 49.8 | |
| Dietitians | 30,000 | 42,100 | 40.3 | |
| Dentists | 100,000 | 130,000 | 31.7 | |
| Physicians | 295,000 | 450,000 | 53.1 | |
| Physicists | 45,000 | 75,000 | 63.9 | |
| Engineers | 1,100,000 | 1,500,000 | 40.2 | Slightly short of requirements |
| Geologists and geophysicists | 30,000 | 36,000 | 20.6 | |
| Optometrists | 17,000 | 21,000 | 23.5 | |
| Architects | 34,000 | 50,000 | 47.1 | In balance with requirements |
| Lawyers | 270,000 | 335,000 | 22.7 | |
| Pharmacists | 121,000 | 130,000 | 7.0 | Slightly above requirements |
| Mathematicians | 70,000 | 110,000 | 60.5 | Significantly above requirements |
| Life scientists | 168,000 | 238,000 | 40.8 | |
| Teachers, elementary and secondary | 2,170,000 | 2,340,000 | 7.8 | |

among fields. Projected imbalances in the form of surpluses, however, do not necessarily mean unemployment; rather they mean that workers trained specifically for an occupation would have to shift to other occupations. Historically, low unemployment rates for college graduates suggest that these workers have shifted their career patterns in response to changes in demand resulting from factors such as cyclical movements in the economy or changes in national priorities. They likely will continue to do so in the future. However, in this situation, our country's trained manpower is not put to its fullest use. Prospective supply-demand conditions can provide information by which individuals and training programs of colleges and other institutions can be adjusted to bring supply and demand into better balance. Manpower balances would result in the maximum utilization of trained manpower and the maximum of goods and services.

The demand for college trained manpower presented in this bulletin reflects the Bureau of Labor Statistics' basic model of the economy in 1980. As such, they are influenced by the economic, political, and technological assumptions underlying the Bureau's model. Specifically, the projections assume that:

The institutional framework of the economy will not change radically through the 1970's.

There will be full employment in 1980, with an unemployment rate of 3 to 4 percent.

The international climate will be improved. The United States will no longer be fighting a war, but the still guarded relationship between major powers will permit no major arms reduction. Defense spending, however, will be reduced from the peak levels of the Viet Nam conflict.

Armed Forces strength will return to approximately the pre-Viet Nam level.

Economic, social, technical, and scientific trends will continue, including the values placed on work, education, income, and leisure.

Fiscal and monetary policies and an active manpower program will achieve a satisfactory balance between low unemployment rates and relative price stability without reducing the long-term economic growth rate.

All levels of government will unite to meet a wide variety of domestic requirements, but Congress will channel more funds to State and local governments.

Estimates of future supply also are greatly influenced by their underlying assumptions. For example, wage differentials, social status of occupations, the availability of training, the nature and extent of student financial support, the length of training, and immigration laws all affect the supply of workers in a particular occupation. Specific assumptions underlying the supply projections presented in this bulletin are:

Occupational status will have the same effect in causing workers to enter specific occupations as in the past.

Trends in the proportion of the college age population who attend college will continue.

Trends in the study patterns of college students will continue.

Entry patterns of college graduates, by field of study, to specific fields of work will continue.

Entry to fields of work by those other than new college graduates including immigrants, upgraded workers, and those reentering the labor force will continue.

## Chapter I. Supply and Demand for Workers Having Bachelor's and Advanced Degrees

### Supply

U.S. colleges and universities are expected to turn out record numbers of graduates each academic year through the 1970's. The number of bachelor's degrees awarded between 1968 and 1980 will increase 48 percent and the number of master's and doctorates degrees will increase even more rapidly, 95 percent and 117 percent, respectively. In numerical terms, about 13.3 million degrees are expected to be awarded between 1968 and 1980, 10.2 million bachelor's degrees, 2.7 million master's degrees, and 400,000 doctor's.

Not all recipients of degrees over the 1968-80 period can be considered part of the effective new supply of college educated workers in the year they receive their degree. Most master's and doctor's degree recipients, for example, are employed before receiving their advanced degree, and therefore, are already counted in the existing supply of college educated workers. Other new degree recipients, especially at the bachelor's level, delay entry into the civilian labor force. Some continue their education, others enter the Armed Forces, and some women graduates become housewives.

Based on past employment patterns, about 9.3 of the 13.3 million new degree recipients will enter the civilian labor force between 1968 and 1980. Bachelor's degree recipients will constitute 8.4 million; master's degree recipients 900,000; and those with doctor's, 18,000. Most persons who will receive degrees during this period and enter the Armed Forces will have returned to civilian life by 1980. Hence, the effect of Viet Nam on the supply of college graduates is assumed to be limited.

Besides new graduates, the supply of college-educated workers between 1968 and 1980 will be augmented by persons who graduated before 1968 but were not in the labor force in 1968. Most will be housewives either reentering or entering the labor force for the first time. Immigrants are still another source of college trained workers, particularly in medicine. These sources are expected to provide 1.2 million additional workers with 4 years or more of college training. This number, added to the available new degree recipients, brings the total from 1968 to 1980 to about 10.5 million.

### Requirements

From 1968 to 1980, the need for workers with college degrees will stem from two sources: Growth in demand and replacements for workers who die, retire, or leave the labor force for other reasons.

Reflecting the continuing influence of many variables, growth will be the major factor underlying manpower needs for college graduates. For example, a growing population will demand more health services resulting in increased requirements for college trained workers. Requirements for scientific and technically trained workers will reflect the complexity of industrial production, expanded housing requirements, and essential improvements in urban renewal and public transportation. In addition, environmental pollution problems will create new demands for scientists and engineers.

A college degree is necessary in many jobs once performed by workers with less education. The proportion of jobs requiring college degrees in professional, technical, and kindred occupations is expected to increase from about three-fifths to about two-thirds between 1968 and 1980;[1] in management, this proportion is expected to grow from one-fifth to nearly one-third.

Over the 1968-80 period, these three factors—growth, replacement, and rising entry requirements—indicate a need for about 10.4 million graduates, 6.1 million for growth, and 4.3 million for replacement.

The methods used to project occupational requirements in this bulletin make them an integral part of the Bureau's projections of Gross National Project and its component distribution, industry output, and industry employment levels. Very briefly, the occupational projections are developed by applying projected occupational composition patterns of industry to the projected industry employment levels as well as by analyzing in depth occupations as they relate to specific economic indicators. For example, enrollments of pupils are used to develop projections of teacher requirements. Detailed discussions of these methods are presented in *Tomorrow's Manpower Needs*, Volume 4, BLS Bulletin 1606, February, 1969; *Occupational Employment Patterns for*

[1] In many individual occupations within this major occupational group, only a small proportion have a college degree, e.g., draftsmen, engineering and scientist technicians, radio operators, and entertainers.

*1960 and 1975,* BLS Bulletin 1599, December, 1968; *Projections 1970,* BLS Bulletin 1536; and briefly in "The United States Economy in 1980" *Monthly Labor Review,* April 1970.

**Supply-demand outlook**

Statistically, a rough balance between the supply and demand for college educated personnel is indicated over the 1970's. Thus, after a long period, a turning point may have been reached in recruiting adequate numbers of highly trained workers. However, this picture does not assure that all imbalances will be eliminated. Many occupations have had shortages for years. An increased supply of graduates offers the hope that the number of students who enter each occupation will more closely match job openings. Later, this bulletin lists several occupations which may have imbalances unless corrective measures are taken.

The incidence of more college-trained workers in these occupations could have an adverse effect on less educated workers. Those without a degree, for example, could have difficulty advancing in occupations such as engineering and accounting, achieving high-level management positions, and obtaining work while completing their education.

**Effect on women**

Changing demand-supply conditions in individual occupations may affect women in view of their increasing labor force participation and their narrow range of occupations. For example, the anticipated adequate supply of teachers in elementary and secondary schools suggests that unless more women enter other high-demand professions, the outlook for college educated women may be less favorable than in the past.

In 1968, about 3.9 million women were employed in the professions. This was a 43-percent increase over 1960, compared with a 35-percent increase for men. The growth of professional women workers reflected expanded employment in teaching, nursing, library science, social and welfare work, and other careers staffed largely by women.

Efforts to improve women's representation in other professions including medicine, dentistry, law, engineering, the natural sciences, architecture, and college teaching have had only limited success. For example, the 21,000 women physicians in 1968 were only about 7 percent of the nearly 300,000 in the country. Only about 3 percent of the Nation's lawyers, or the same proportion as 15 years ago, are women. Engineering and science have attracted relatively few women although their participation in the natural sciences is increasing.

Women have made some progress in employment in the social sciences, psychology, health technology, physical and occupational therapy, recreation, personnel, accounting, mathematics, and statistics.

Over the 1968–80 period, the number of women graduates is expected to increase two-thirds or twice the rate for men. Traditional "women's" fields will not be able to absorb this increase because about 2 out of every 5 women in professional and related jobs are elementary or secondary school teachers. Through proper counseling, women can be made aware of this expected sharp decline in the proportion of new graduates who will be needed in teaching. Some may enter social work, chemistry, engineering, or other shortage areas to help achieve a supply-demand balance and improve their own employment prospects. Unless women enlarge the range of occupations, strong competition for jobs may develop.

## Chapter II. Analysis of Supply-Demand in Selected Occupations Generally Requiring A Bachelor's or Advanced Degree for Entry

Different supply-demand conditions are in the offing among individual occupations for the 1970's, despite the expected rough balance for college graduates as a whole. The following statements present prospective supply-demand conditions for several selected occupations if current trends in patterns of study and entry to the profession continue. These statements, therefore, are not intended to forecast a shortage, surplus, or balance of supply relative to demand, but to indicate prospective imbalances if current trends continue.

> The projections of degrees awarded used in this report are those developed by the U.S. Office of Education. The Office of Education's projections assumes that enrollment patterns and the propensity of students to study particular fields will continue trends experienced over the past 10 years.

### Engineers

*Employment.* Nearly 1.1 million engineers were employed in the United States in 1968. More than half—about 580,000 in 1968—were employed in manufacturing industries. Within manufacturing, large numbers were employed in the electrical equipment, aircraft and parts, machinery, ordnance, chemicals, instruments, and fabricated metals product industries. About 300,000 engineers were employed in private nonmanufacturing industries in 1968, primarily in construction, public utilities, engineering and architectural services, and business and management firms.

Federal, State, and local government agencies employed almost 150,000 engineers in 1968. Of these, almost 60 percent were employed by the Federal Government, primarily the Department of Defense. Engineers in State and local government were employed primarily by highway and public works departments. Educational institutions employed about 39,000 engineers in 1968, in research as well as in teaching positions. Relatively few (6,000) were employed by nonprofit organizations.

Engineers are employed in every State. Within the private industry sector, however, approximately two-thirds are employed in only 10 States—California, New York, Michigan, Ohio, Illinois, Pennsylvania, Texas, New Jersey, Massachusetts, and Indiana. Engineers specializing in certain branches of the profession are concentrated in particular industries that have unique patterns of regional concentration. Aerospace engineers, for example, are employed mainly in the aircraft and parts industry which is concentrated in the Pacific region.

*Projected Needs.* Over the 1968–80 period, employment requirements for engineers are expected to increase from about 1.1 million to more than 1.5 million. This 40-percent increase represents a 2.9-percent annual rate of growth,[2] compared with an average of 3.7 percent a year from 1960 to 1968.

Among the factors underlying the anticipated increase in demand for engineers are population growth and the resulting expansion of industry to meet the demand for additional goods and services. More engineering time is required to develop new products, industrial processes, and increased automation. R & D expenditures are expected to rise rapidly through the 1970's although more slowly than in the past. Increased research will expand existing fields of work and initiate new areas. One of the major fields to expand is pollution control.

More specific factors are expected to increase requirements in certain branches of engineering. Continued rapid growth is expected for industrial engineers, for example, because of the growing importance of scientific management and safety engineering to reduce costs and increase productivity. Increased requirements for civil engineers reflect the growing demands for housing, industrial buildings, and highways; and work relative to urban living, such as improved water and sewage systems.

In addition to manpower needs of 430,000 for growth, nearly 210,000 engineers will be needed to replace those who die, retire, or leave the labor force. Another 245,000 engineers will be required to replace those who transfer to other occupations. Growth and replacement needs are expected to total about 885,000, an average of 74,000 a year from 1968 to 1980.

*Supply-demand.* New graduates are the primary source of new engineers. However, significant numbers come from transfers from other occupations, including upgraded technicians, reentrants into the labor force,

[2] A compound rate has been used throughout this report to describe annual rates of growth.



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including those from the Armed Forces, immigrants, and new graduates who did not major in engineering.

If past patterns of entry from nonengineering graduates continue, an average of 36,000 annually can be expected between 1968 and 1980. Under this assumption, only an average of about 38,000 new engineering graduates would have to enter the profession annually to meet requirements.

Followup studies indicate that only about 85 percent of all new engineering graduates enter the profession. Based on this entry rate, an average of approximately 45,000 engineering graduates would be needed annually to obtain 38,000 entrants.

In 1968, about 37,000 bachelor's degrees were granted in engineering. To meet requirements, the number of bachelor's degrees granted annually in engineering over the 1968-80 period will have to average about 21 percent above 1968 levels. From 1968 to 1980 the U.S. Office of Education estimates the average annual number of bachelor's degrees in engineering will be about 14 percent above 1968 levels. Thus, based on past patterns of study and entry to the profession, the supply of engineers would fall slightly short or at best barely meet the need.

*Women.* In 1968 women engineers, constituting less than 1 percent of all workers in the profession, numbered approximately 8,000. Although employed in virtually all branches of engineering, most women are employed as either industrial or electrical engineers.

About 210 women, almost 50 percent more than the number in 1960, received bachelor's degrees in engineering in 1968. This growth, however, has not kept pace with the increase in all bachelor's degrees awarded to women.

## Chemists

*Employment.* Chemistry is the largest field of employment in the physical sciences. Approximately 130,000 chemists were employed in the United States in 1968. More than 70 percent—over 90,000 in 1968—were employed by private industry. The major industrial employer of chemists, the chemicals manufacturing industry, employed over 45 percent of those in private industry. Relatively large numbers of chemists also were employed in industries manufacturing food, instruments, rubber, petroleum, paper, electrical equipment, textiles and apparel, and primary metals products. Independent laboratories, consulting firms, and distributors of chemicals, pharmaceutical, food, and petroleum products also employed significant numbers.

In 1968, nearly 24,000 chemists did research and teaching in colleges and universities. Government agencies—Federal, State, and local—employed about 12,000. About three-fourths of these worked in Federal Government agencies, chiefly the Departments of Defense; Health, Education, and Welfare; Agriculture; and Interior. Only about 3,000 chemists worked for State and local governments, primarily in agencies concerned with health or agriculture. A small number, about 2,000 in 1968, worked for nonprofit research organizations.

Chemists are employed in all States, in small as well as large cities. Nearly one-fifth of all chemists, however, were located in four metropolitan areas—New York, Chicago, Philadelphia, and Newark. About half worked in the six States of New York, New Jersey, California, Pennsylvania, Ohio, and Illinois.

*Projected Needs.* Over the 1968-80 period, employment requirements for chemists are expected to increase 56 percent from approximately 130,000 to slightly over 200,000. This 3.8-percent annual rate of growth is faster than the 3.5-percent from 1960 to 1968.

Chemists will be required in increasing numbers for R & D, the activity of nearly half of all chemists Expenditures for R & D will probably continue to rise, although more slowly than in the past. Resulting from research are jobs for chemists in types of work such as in the manufacture of products including plastics, manmade fibers, drugs, fertilizers, and high energy and nuclear fuels for missiles and rockets. Combating air and water pollution should also be a rapidly growing field for chemists.

The number of college and university chemistry teachers is projected to at least double by 1980 because of the large increase in enrollments expected through the 1970's. The greatest demand will be for those having Ph. D. degrees; many positions especially in 2-year colleges will be filled by chemists who have only the master's degree.

In addition to manpower needs of over 70,000 resulting from increased requirements, nearly 80,000 chemists will be required to replace those who die, retire, or transfer. Between 1968 and 1980, openings resulting from both growth and replacements are thus expected to total more than 150,000, an average of almost 13,000 a year.

*Supply-demand.* Annual requirements for chemists may be met by persons who shift to chemistry from other occupations; from persons not in the labor force, including housewives and those in the Armed Forces; from immigrants; from new college graduates who did not major in chemistry; as well as new college graduates majoring in chemistry. If the past patterns of entry to chemistry—new graduates and others—continue, then approximately 17,000 bachelor's degree graduates in chemistry would be needed annually to meet projected requirements.

In 1968, about 10,800 bachelor's degrees were granted in chemistry. To meet requirements, the number of bachelor's degrees granted annually in chemistry will have to average almost 65 percent above 1968 levels.

From 1968 to 1980 the U.S. Office of Education estimates the average annual number of bachelor's degrees in chemistry will be about 5 percent above 1968 levels. Thus, based on past patterns of study and entry to the profession, the supply of chemists is expected to fall short of demand.

*Women.* Women chemists representing less than 10 percent of all workers in the profession, numbered approximately 10,000 in 1968. Chemistry is the largest field of employment for women in the physical sciences.

In 1968, about 1,900 women or 22 percent more than the 1,580 awarded in 1960, received bachelor's degrees in chemistry. This increase has not kept pace with the growth in all bachelor's degrees awarded women over the 1960–68 period, nor with the total number of degrees awarded in chemistry over the same period.

**Physicists**

*Employment.* More than 45,000 physicists were employed in the United States in 1968. Almost 18,000 were employed by private industry; half of these worked in the electrical equipment, ordnance, chemicals, and aircraft and parts industries. Commercial laboratories and independent research firms employed more than a fourth of those in private industry.

In 1968, about 20,000 did research or taught in colleges and universities. Federal Government agencies employed 6,500, nearly three-fourths in the Department of Defense. Significant numbers of physicists also were employed by the National Bureau of Standards and the National Aeronautics and Space Administration. More than 1,500 physicists worked for nonprofit organizations.

Physicists are concentrated in those areas having industrial concentrations and large colleges and universities. Nearly one-fourth were employed in four metropolitan areas—Washington, D.C., Boston, New York, and Los Angeles-Long Beach. About one-half of the total were employed in only six States—California, New York, Massachusetts, Pennsylvania, Illinois, and Ohio.

*Projected needs.* Over the 1968–80 period, employment requirements for physicists are expected to increase about 64 percent, from more than 45,000 to slightly over 75,000. This 4.2 percent annual rate of increase is substantially slower than the 5.9 percent between 1960 and 1968.

Physicists will be required in substantial numbers to perform complex research and development. They have made substantial contributions to scientific progress in recent years in such areas as nuclear energy, electronics, communications, and aerospace and are expected to continue to do so. Expenditures for R & D will continue to rise, although more slowly than in the past. Also, there probably will be a strong demand for physicists to teach.

In addition to manpower needs of almost 30,000 resulting from increased requirements, about 26,000 will be required to replace those who die, retire, or transfer to other fields of work. Thus, manpower needs will total more than 55,000, an average of 4,600 a year.

*Supply-demand.* New graduates of physics curriculums are the major source of supply of new physicists. However, many entrants also are derived from graduates who did not major in physics; from immigrants; from persons reentering the labor force, including housewives and those in the Armed Forces; and from persons employed in other occupations.

If past patterns continue in the number of entrants from other than new graduates with degrees in physics, only about 3,600 physics graduates would have to enter the field each year on the average over the 1968–80 period. For 3,600 new physics graduates to enter the profession annually, however, many more will have to obtain bachelor's degrees. Followup studies indicate that less than one-half of all persons who receive bachelor's degrees in physics eventually enter the occupation. Based on past patterns of entry, therefore, approximately 8,000 physics graduates would be needed annually to meet projected requirements.

In 1968, about 5,000 bachelor's degrees were granted in physics. To meet requirements, the average number of bachelor's degrees granted annually in physics will have to be about 60 percent above 1968 levels. From 1968 to 1980, the U.S. Office of Education estimates the average annual number of bachelor's degrees in physics will be less than 3 percent above 1968 levels. Thus, based on past patterns of study and entry to the profession, the supply of physicists is expected to fall short of demand.

*Women.* In 1968 approximately 1,500 women physicists—about 3.5 percent of total—were employed in research or teaching.

In 1968, about 290 women received bachelor's degrees in physics representing about 6 percent of the total. This represents an increase of almost 75 percent over the 168 physics degrees awarded to women in 1960, compared with an increase of only 19 percent in the total number of bachelor's degrees awarded in physics. Over the same period, however, the total number of bachelor's degrees awarded to women more than doubled.

**Life scientists**

*Employment.* In 1968, approximately 168,000 persons were employed as life scientists in the United States. Of these, about 48,000 were agricultural scientists, more than 66,000 were biological scientists, and about 54,000 were medical scientists.

In 1968, 56 percent of all life scientists were employed by colleges and universities. Medical schools and associated hospitals employed particularly large numbers of

those. State agricultural colleges and agricultural experiment stations employed sizeable numbers of agronomists, horticulturists, and other agricultural related specialists.

Federal Government agencies employed nearly 26,000 life scientists in 1968, primarily in the Department of Agriculture. The estimated 19,000 life scientists employed by State and local government agencies in 1968 were mostly fish and wildlife specialists, microbiologists, and entomologists working in the areas of conservation, plant breeding, and in the detection and control of diseases.

Nearly 25,000 life scientists worked in private industry in 1968. Among the major industrial employers were manufacturers of pharmaceuticals, industrial chemicals, and food products. Almost 5,000 were employed by nonprofit foundations and privately financed research organizations.

Although life scientists are employed in all States, nearly two-fifths were located in only five States—California, New York, Pennsylvania, Illinois, and Maryland. About 1 of every 10 life scientists were located in only two metropolitan areas—Washington, D.C. and New York, N.Y.

*Projected needs.* Employment requirements for life scientists are expected to increase 41 percent from about 168,000 to almost 238,000 over the 1968-80 period. This annual growth rate of 2.9 percent is slower than in the 1960-68 period when employment increased 7.0 percent a year. Much of the past growth can be traced to increased requirements in colleges and universities. Causes for increasing employment have been twofold—the rise in enrollments and the extensive growth in research.

One major factor which will contribute to the increase in employment of life scientists is the anticipated growth in medical research sponsored by the Federal Government and voluntary health agencies, including those supporting research on heart disease, cancer, and birth defects. Increased research in relatively new areas such as space biology, environmental health, and biological oceanography also will require more life scientists.

Increased expenditures for R & D by private industry also will increase the demand. Furthermore, more stringent health standards of the Federal regulatory agencies are likely to demand additional life scientists in private industry for research and testing before new drugs and chemicals are made available to the public.

Larger college and university enrollments expected during the 1970's will also increase requirements for life scientists, primarily for those holding the Ph. D.

In addition to manpower needs of almost 70,000 resulting from growth of the profession, nearly 50,000 life scientists will be needed to replace those who die, retire, or leave the labor force and another 63,000 life scientists for those who transfer to other occupations. Manpower needs for both growth and replacement are thus expected to total over 180,000 an annual average of 15,000 over the 1968-80 period.

*Supply-demand.* New college graduates with majors in the life sciences are the major source of supply of new life scientists. However, a substantial portion of the supply of life scientists comes from new graduates who did not major in the life sciences, from transfers from other occupations, from immigrants, and from persons not in the labor force, including those in the Armed Forces.

If past patterns of entry to the life sciences of workers other than new graduates having degrees in life science were to continue, and if the proportion of new graduates entering the field continue as indicated by followup studies, approximately 15,000 life science graduates would be needed annually to meet projected requirements.

In 1968, about 42,000 bachelor's degrees were granted in the life sciences. To meet requirements, the number of bachelor's degrees granted annually in the life sciences could be as much as two-thirds below 1968 levels. Projections developed by the U.S. Office of Education show the average annual number of bachelor's degrees in the life sciences increasing by about 34 percent above 1968 levels over the 1968-80 period. Thus, a more than adequate supply of life scientists should result if students continue to elect these fields in the same proportion as in the past. Many graduates who would like to be life scientists will probably have to work in other fields.

*Women.* Women represented about 10 percent of the estimated 168,000 life scientists employed in 1968. Although employed as agricultural, biological, and medical scientists, most women worked as either biological or medical scientists.

In 1968, more than 9,500 or 20 percent of all bachelor's degrees in the life sciences were granted to women. This is an increase of about 125 percent over the 4,200 life science degrees awarded to women in 1960 compared with the 75 percent increase in the total number of bachelor's degrees in the life sciences.

**Geologists and geophysicists**

*Employment.* Approximately 30,000 geologists and geophysicists were employed in the United States in 1968. Almost three-fifths of the total were employed by private industry, primarily by mining and independent consulting firms.

Approximately 2,800 geologists and geophysicists were employed by Federal Government agencies in 1968, chiefly by the Department of the Interior in the U.S. Geological Survey, the Bureau of Mines, and the Bureau of Reclamation. State agencies employed slightly over 1,000. Some worked on surveys conducted in cooperation with the U.S. Geological Survey.

In 1968, colleges and universities employed about 8,000 geologists and geophysicists both in teaching and research. A few members of these professions worked for nonprofit research institutions and museums.

Geologists and geophysicists generally work in areas having rich mineral deposits. In 1968, nearly half were located in only five States—Texas, California, Louisiana, Colorado, and Oklahoma. Some employed by American firms are assigned to work in foreign countries.

*Projected Needs.* Over the 1968-80 period, employment requirements for geologists and geophysicists are expected to increase from approximately 30,000 to almost 36,000. This increase of 20 percent represents a substantially slower annual rate of growth, 1.6 percent, than in the 1960-68 period when employment increased by an average of 6.1 percent a year.

An increasing population and continued emphasis on industrial growth will require petroleum, minerals, and fresh water resulting in increased requirements for geologists and geophysicists. These workers will be needed to devise techniques for exploring deeper within the earth's crust, both on land and under the sea, and to work with engineers to develop more efficient methods of recovering natural resources.

Space-age activities such as the exploration of the outer atmosphere and the analyses of surface conditions on the moon and other planets also will require additional geologists and geophysicists.

In addition to manpower needs of slightly over 6,000 resulting from increased requirements, about 16,000 geologists and geophysicists will be required to replace those who die, retire, or transfer to other fields. From 1968 to 1980, manpower needs for both growth and replacement are thus expected to total over 22,000, an average of 1,800 a year.

*Supply-demand.* After allowances are made for entrants from new college graduates who did not major in geology and geophysics; from immigrants; from persons not in the labor force including housewives and those in the Armed Forces, and from persons employed in other occupations, fewer than 1,000 new geologists and geophysicists graduates would have to enter the profession annually to meet requirements. For this number to enter the profession annually, however, many more will have to obtain bachelor's degrees. Fewer than one-half of all persons who receive degrees in geology and geophysics enter the profession, based on past patterns of entry. Approximately 2,100 geology and geophysics graduates would, therefore, be needed annually to meet projected requirements.

In 1968, about 2,100 bachelor's degrees were granted in the earth sciences. To meet requirements, the average number of bachelor's degrees granted annually would have to remain at 1968 levels. From 1968 to 1980, the U.S. Office of Education estimates the average annual number of bachelor's degrees in the earth sciences will decline more than 7 percent from 1968 levels. Thus, based on past patterns of study and entry to these professions, the supply of geologists and geophysicists is expected to fall slightly short of demand.

*Women.* Only about 3 percent of the approximately 30,000 geologists and geophysicists employed in 1968 were women. They worked for educational institutions or government agencies; very few were employed in private industry.

In 1968, women received 225 or 11 percent of the bachelor's degrees awarded in the earth sciences. This represents an increase of about 190 percent over the 80 earth science degrees awarded to women in 1960. Over the same period, the total number of bachelor's degrees awarded in the earth sciences declined 17.5 percent.

**Mathematicians**

*Employment.* Almost 70,000 men and women were employed as mathematicians in 1968. More than half—over 36,000—worked in private industry, primarily in independent research and development firms, and in the ordnance, machinery, aircraft, electrical equipment, and chemicals industries. Insurance companies employed a significant number as actuaries.

In 1968, nearly 25,000 mathematicians worked for colleges and universities; 4,800 for the Federal Government, mostly in the Department of Defense; and small numbers for State and local governments and nonprofit organizations.

Mathematicians are employed in all States. However, they are concentrated in those States having large industrial concerns and sizeable college and university enrollments. Over half of the total were found in only seven States—California, New York, Massachusetts, Pennsylvania, Illinois, Maryland, and New Jersey. Nearly one-fourth were located in just three metropolitan areas—New York, N.Y.; Washington, D.C.; and Los Angeles-Long Beach, Calif.

*Projected Needs.* Over the 1968-80 period, employment requirements for mathematicians are expected to increase 60 percent from almost 70,000 to about 110,000. This 4.0-percent annual rate of growth is substantially slower than the 1960-68 period when employment increased an average of 9.4 percent a year.

A strong demand for mathematics in teaching and research positions is expected in colleges and universities. The number of mathematics majors and students majoring in other fields but taking mathematics courses are expected to increase sharply. Over 50 percent of the growth requirements in the profession will result from the anticipated expansion in colleges and universities.

Mathematicians also will be required in substantial numbers to solve complex R & D problems in engineering, natural and social science, military sciences, operations research, and business management. Such work

requires a high degree of mathematical competence, familiarity with electronic computers, and a broad knowledge of one of these fields of application.

In addition to manpower needs of almost 42,000 resulting from increased requirements, nearly 60,000 mathematicians will be required to replace those who die, retire, or transfer to other fields of work. Over the 1968–80 period, openings resulting from growth and replacement are expected to total more than 100,000, an average of about 8,400 a year.

*Supply-demand.* Annual requirements for mathematicians may be met by persons who shift to occupations in mathematics from other occupations; from persons not in the labor force, including housewives and those in the Armed Forces; from immigrants; from new college graduates who did not major in mathematics; as well as from the major source, new college graduates receiving degrees in mathematics. Based on past patterns of entry, approximately 22,000 new bachelor's degree graduates in mathematics would be needed annually to meet projected requirements.

In 1968, approximately 24,000 bachelor's degrees were granted in mathematics. To meet requirements, therefore, the number of bachelor's degrees granted annually in mathematics could decline slightly below 1968 levels. From 1968 to 1980, the U.S. Office of Education, estimates average annual number of bachelor's degrees in mathematics will increase over 65 percent above 1968 levels. Thus, a more than adequate supply of mathematicians should result if students continue to elect this field as in the past. Many mathematics graduates who would perhaps prefer careers in mathematics will probably have to work elsewhere. The education and training necessary for a degree in mathematics is also an excellent foundation for a number of other occupations. An increasing proportion of mathematics graduates likely will seek and find jobs in statistics, systems analysis, engineering, and physics throughout the 1970's.

*Women.* About 10 percent of the approximately 70,000 persons employed as mathematicians in 1968 were women. In 1968, over 8,700 degrees, more than one-third of the bachelor's degrees awarded in the field, were awarded to women. This number, which was more than 180 percent higher than the 3,100 awarded in 1960, has more than kept pace with the growth in all bachelor's degrees awarded women over the 1960–68 period and the 110-percent increase in the total number of bachelor's degrees awarded in mathematics.

**Physicians**

*Employment.* Nearly 295,000 physicians were professionally active in early 1968. About 190,000, more than three-fifths of the total, were engaged in private practice. Approximately 45,000 were interns or residents in hospitals. Nearly three-fifths of the 37,000 who held full-time staff positions in hospitals, were in Government hospitals. Others were employed in private industry, State and local health departments, medical schools, research foundations, and professional organizations.

About one-third of the physicians engaged in private practice are general practitioners. The other two-thirds specialized in 1 of 33 fields recognized by the medical profession.

In 1968, more than 40 percent of all physicians were in five States: New York, California, Pennsylvania, Illinois, and Ohio. In general the Northeastern States have the highest ratio of physicians to population, and the Southern States, the lowest. General practitioners are much more widely distributed geographically than specialists, who tend to be concentrated in large cities.

*Projected needs.* Manpower needs for physicians are expected to rise more than one-half from nearly 295,000 to 450,000 between 1968 and 1980. This 3.6 percent is faster than the 2.9 percent in the 1960–68 period. However, the number of new graduates of medical schools limited employment growth in the past whereas the 1980 requirements were estimated without consideration of possible future supply limitations.

In addition to growth needs of 155,000, nearly 90,000 physicians will be needed to replace those who are expected to die, retire, or stop practicing because of other reasons between 1968 and 1980.

Important factors underlying the expected very rapid growth in requirements for physicians between 1968 and 1980 are the increasing population, particularly in the youngest and oldest age groups, those needing the most health care; the rising health consciousness of the public; and the trend toward higher standards of medical care. Demand for physicians also will increase as a result of expanding prepayment programs for hospitalization and medical care; continued Federal Government provisions of medical care for members of the Armed Forces, their families, veterans; and the continuing growth in public health, rehabilitation, industrial medicine, and mental health. In addition, more physicians will be needed for research and for new and expanding medical schools.

Projections of manpower needs for physicians are estimates for workers in 1980 that were developed under economic assumptions rather than needs based on specific goals of medical care. For example, physician requirements are based on anticipated increases for services resulting from such factors as population growth, rising expenditures for health care, and research rather than some predetermined standards of health care.

*Supply-demand.* New medical graduates and immigrants are the primary sources of supply for physicians in the United States. To meet the projected need for 245,000 new physicians between 1968 and 1980—155,000 for growth and 90,000 for replacement—these sources

would have to average about 20,000 new physicians annually over the 12-year period, 1968-80. If medical schools continue at their current capacity and the annual number of immigrant physicians does not change significantly from the level of recent years, however, only about 10,000 persons would become physicians each year between 1968 and 1980.[3] On this basis, the average annual output of our medical schools would have to be increased about 10,000 if the implied deficit is to be met. Some expansion is being provided for under the Health Professions Educational Assistance Act of 1963 but not enough to meet requirements projected in this report.

*Women.* The proportion of women in medicine is small—about 7 percent of all practicing physicians in 1968, nearly 21,000. About 8 percent of all first-professional degrees conferred in medicine in 1967-68 were received by women, up from 6 percent 8 years earlier. The number of such degrees received by women totaled 626 in 1967-68, according to Office of Education data, an increase of three-fifths over the 387 awarded in 1959-60. In contrast, the total number of degrees conferred in medicine increased 13 percent from 7,032 to 7,944 over the period.

**Dentists**

*Employment.* In 1968, about 100,000 dentists, 3 percent more than the 93,000 employed in 1960, were at work in the United States. Nine out of 10 dentists were in private practice. About 6,800 of the remainder served as commissioned officers in the Armed Forces; about 1,300 had other types of Federal Government positions—chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service; fewer than 2,000 held full-time positions in schools, hospitals, or State and local health agencies.

Dentists tend to be concentrated in large cities and populous States. In early 1968, about one-third of all dentists were located in New York, California, Pennsylvania, and Illinois.

*Projected needs.* Manpower needs for dentists are expected to rise almost one-third from 100,000 employed in 1968 to 130,000 required in 1980. This annual rate of growth, 2.2 percent a year is faster than the 1960-68 period when employment increased 0.9 percent a year. However, as with physicians, the number of new graduates of dental schools has limited past employment growth. The 1980 requirements projections were developed exclusive of possible future supply limitations.

In addition to growth needs of 30,000, about 27,000 dentists will be needed to replace those who die, retire, or stop working for other reasons over the 1968-80 period.

Factors contributing to the expected rapid growth in demand for dental services are expanding population; the growing awareness of the importance of regular dental care; and the development of pre-payment arrangements so that people may obtain dental service more easily. Expanded dental research will require more trained personnel; dental public health programs will need qualified administrators; and dental colleges will need additional faculty members.

Technological developments, such as new equipment and drugs, and extensive use of auxiliary workers should permit individual dentists to care for more patients. Improved dental hygiene and fluoridation of community water supplies will prevent some tooth and gum disorders but probably will stimulate rather than restrict the demand for services by preserving teeth that might otherwise be extracted.

Projections of manpower needs for dentists are estimates for workers in 1980 developed under economic assumptions rather than needs based on specific standards of dental care.

*Supply-demand.* The supply of new dentists in the United States is drawn primarily from graduates of dental schools. To meet projected needs for 57,000 new dentists between 1968 and 1980—30,000 for growth and 27,000 for replacement—an average of 4,900 new dentists would have to graduate each year over the 12-year period. In 1968, only 3,400 dentists graduated from these schools. Thus, the annual number of dental graduates will have to be increased 1,500 above current levels between 1968 and 1980 to meet projected requirements. As a result of financial assistance under the Health Professions Educational Assistance Act of 1963, dental school facilities are expected to increase, but not enough to meet projected requirements.

*Women.* In 1968, approximately 2,000 women, about 2 percent of the profession, were dentists.

Only 47 or 1.4 percent of the total 3,422 first professional degrees conferred in dentistry in 1967-68 were received by women, according to Office of Education data.

**Dietitians**

*Employment.* In 1968, about 30,000 dietitians, an increase of one-fifth over the 25,000 employed in 1960, were employed. About two-thirds of all dietitians, including about 1,100 who were employed by the Veterans Administration and the U.S. Public Health Service, worked in hospitals and related institutions. A sizeable number were employed by colleges, universities, and school systems as teachers or as dietitians in food-service programs. Most of the remainder worked for public health agencies, restaurants or cafeterias, and

[3]The number of foreign trained physicians licensed to practice medicine in the United States averaged about 1,000 per year between 1964 and 1968.

large companies that operate food-service programs for their employees. Some dietitians were commissioned officers in the Armed Forces.

*Projected needs.* Employment requirements are expected to increase 40 percent from about 30,000 to more than 42,000 between 1968 and 1980. This 2.8-percent annual rate growth is faster than the 1960-68 period when employment increased 2.3 percent a year.

Contributing to the very rapid increase in requirements for dietitians is the increase in the patient load of hospitals, nursing homes, and other extended care facilities primarily resulting from population growth and the increasing ability of the population to pay for institutional care. In addition, more dietitians will be needed to direct food services for the growing number of schools, day care centers, industrial plants, and to work in research and public health programs.

In addition to the more than 12,000 to staff new positions, nearly 20,000 dietitians will be needed to replace those who die, retire, or leave the labor force for family or other reasons over the 1968-80 period.

*Supply-demand.* New graduates of bachelor's degree programs in home economics and experienced dietitians reentering the occupation, primarily housewives returning to work when their family responsibilities no longer require their full-time attention, are the primary source of entrants to this profession. A few enter after receiving bachelor's degrees in other fields.[4]

After allowances for entrants from other fields of study and reentry of women assuming they follow the reentry patterns of women teachers, home economics programs will have to provide an annual average of about 1,800 entrants over the 1968-80 period. Although 7,350[5] persons received degrees in home economics in 1968, only about one-fifth or about 1,500 were estimated to have become dietitians based on data available on the working patterns of new degree recipients. Thus, to obtain 1,800 entrants from these programs, the average annual number of graduates must expand by one-fifth above 1968 levels over the 1968-80 period. Projections developed by the U.S. Office of Education show the average annual number of bachelor's degrees in home economics, including home economics education, declining by 13.5 percent over the 1968-80 period. Thus, based on past patterns of study and entry to the occupation, the supply of dietitians is expected to fall short of demand.

*Women.* More than 90 percent of all dietitians in 1968 were women. The number of men employed has been growing slowly but steadily. Men are likely to find increasing employment opportunities, especially as administrative dietitians in college and university food services, hospitals, and commercial eating places.

Ninety-eight percent of the degrees conferred in home economics in 1968 were women. By 1980, men are expected to increase their share of bachelor's degrees in home economics to about 6 percent.

**Pharmacists**

*Employment.* More than 121,000 pharmacists, 6 percent more than the 114,000 employed in 1960, were working in the United States in 1968. Almost 50 percent of the 103,000 working in retail pharmacies were owners or part owners of drugstores. Most of the remainder were employed by hospitals, pharmaceutical manufacturers, and wholesalers. Others worked in the clinics of the Veterans Administration and the U.S. Public Health Service, taught in colleges of pharmacy, worked for State and local government agencies, or served in the Armed Forces.

*Projected Needs.* Between 1968 and 1980, employment requirements for pharmacists are expected to increase from more than 121,000 to 130,000 or 7 percent. This represents a slightly lower annual rate of growth, 0.6 percent, than in the 1960-68 period when employment increased by an average of 0.7 percent a year.

Compared with the 9,000 pharmacists needed for the growth of the occupation, about 45,000 pharmacists will be needed to replace workers who die, retire, or leave the labor force for other reasons between 1968 and 1980.

Some pharmacists will be needed for newly established pharmacies, particularly in residential areas and suburban shopping centers. Also, some drugstores may hire additional pharmacists because of a trend toward shorter working hours. However, continuing expansion in the preparation of pharmaceuticals by manufacturing establishments will partially offset the need for additional pharmacists as well as the trend towards larger drugstores, and the greater use of pharmacist assistants.

*Supply-demand.* The new supply of pharmacists in the United States is drawn primarily from new graduates of colleges of pharmacy to meet the projected need of 54,000–9,000 for growth and 45,000 for replacement. These schools would have to average 4,400 new pharmacists annually over the 12 years. In 1968, about 4,000 students graduated from colleges of pharmacy. Thus, to meet projected requirements the average number of graduates between 1968 and 1980 must be increased about 400 or 10 percent.

Over the 1968-80 period, the U.S. Office of Education estimates the average annual number of bachelor's degrees in pharmacy will increase about 25 percent over the 1968 level. Thus, the supply of pharmacists is expected to slightly exceed projected requirements.

[4] After completion of 4 years of college, the profession encourages completion of a 12 or 18 month internship program or 3 years of preplanned experience.

[5] Number of degrees in home economics excluding home economics education since dietitians seldom become teachers.

*Women.* Women represented about 8 percent of all pharmacists in 1968, about 9,700. They are employed in all branches of the profession.

Women received 610, or 15 percent of the total 3,987 bachelor's and first-professional degrees conferred in pharmacy in 1967-68, an increase of 56 percent over the 390 awarded in 1959-60. Women averaged about 13 percent of the 3,500 degrees conferred annually in pharmacy over the period.

**Optometrists**

*Employment.* Approximately 17,000 optometrists, virtually the same number as in the early 1950's, were in practice in the United States in 1968. More than nine-tenths were self-employed. Several hundred served in the Armed Forces and some taught in colleges of optometry. The remainder worked for established practitioners, health clinics, hospitals, optical instrument manufacturers, or government agencies.

About 4 out of 10 optometrists are located in five States—California, Illinois, New York, Pennsylvania, and Ohio. Many small towns and rural areas, especially in the South, have no optometrists.

*Projected needs.* Between 1968 and 1980, employment requirements are expected to increase from 17,000 to 21,000, or nearly one-fourth. The demand for the services of optometrists is expected to rise moderately primarily as a result of some basic factors that will contribute to increased demand for other health workers—population growth and the increasing ability of individuals to pay for health care. In addition, the general public is becoming more conscious of the need for regular examinations since greater demands are being made on the eyes and because of the necessity of good vision for efficiency at work and in school.

The increasing use of assistants and technicians in optometrists' offices, however, will tend to slow the growth of employment requirements for optometrists. Also, some of the expanded demand for eye care is expected to be met by ophthamologists, medical doctors who are eye specialists.

In addition to the growth needs of 4,000, 5,800 optometrists will be needed to replace those who die or retire over the 1968-80 period.

*Supply-demand.* New graduates of schools of optometry are the primary source of supply for new optometrists in the United States. To meet the projected need for 9,800 optometrists between 1968 and 1980—4,000 for growth and 5,800 for replacement—schools would have to provide an annual average of more than 800 graduates over this period. In 1968, optometry schools provided only about 450 graduates. Thus, to meet projected 1980 requirements, the average annual number of graduates of optometry schools must be increased about 350 over current levels. Part of the increase is expected to be met by expanding training facilities resulting from assistance received under the Health Professions Educational Assistance Act of 1963. However, based on planned expansion to 1980, the supply of optometrists is expected to fall short of requirements as projected in this report.

*Women.* An estimated 2 percent (350) of all optometrists in 1968 were women. Women received 11 or only 2.4 percent of the 452 bachelor's and first-professional degrees conferred in optometry in 1967-68 according to Office of Education data. Over the 1959-60 to 1967-68 period, women have averaged less than 2 percent of all such graduates.

**Elementary and secondary schoolteachers**

*Employment.* Nearly 2.2 million elementary and secondary schoolteachers, over one-third more than in 1960, were employed during academic year 1968-69. The largest part was kindergarten and elementary teachers numbering more than 1.2 million in the 1968-69 school year, or about one-fourth more than the 990,000 working in 1960. About 940,000, an increase of more than one-half over the 610,000 in 1960, were employed in the Nation's public and private secondary schools in 1968-69.

*Projected needs.* The increase in the school-age population has slowed and caused a decline in the number of additional teachers required annually. During the 1970's, school enrollment will level off even more. Reflecting the recent decline in births, elementary schools are expected to decline in enrollment up to 1976. After that, elementary enrollments will probably begin to climb slowly, but in 1980 they are expected still to be slightly below the 1968 level. Secondary school enrollments will rise about one-fifth over the 1968-76 period, but only about two-fifths as fast as during the preceding 8 years.

Employment requirements for teachers are expected to rise about 8 percent between 1968 and 1980—from 2.17 million to about 2.34 million despite an anticipated continuation of the decline in pupil-teacher ratios. This compares with an increase of more than one-third during the 1960-68 period when employment of classroom teachers in elementary and secondary schools increased from 1.60 million to 2.17 million.

Many more new teachers will be needed to replace those who retire, die, or leave the profession for other reasons than will be needed to handle increased enrollments. This will be true even if pupil-teacher ratios are reduced further, in line with recent trends. Fewer than 200,000 teachers will be needed to staff new positions between 1968 and 1980, compared with 2.1 million to replace those who retire, die, or leave the profession for other reasons. In addition, about 90,000 teachers will be needed to replace persons not meeting certification

requirements. Altogether, requirements for new teachers from these sources are expected to total about 2.4 million over the 1968–80 period—roughly 1.2 million for elementary and 1.2 million for secondary school positions.

*Supply-demand.* To meet the projected need of 2.4 million elementary and secondary teachers between 1968 and 1980, the number of persons entering the profession must average about 200,000 a year. The supply is expected to exceed demand if recent entry patterns continue.

Reentrants, late entrants, and new degree recipients are primary sources of teacher supply. Between 1968 and 1980, almost 11 million bachelor's degrees, or 5.3 million more than the number awarded the previous 12 years, are expected to be awarded. More than 20 percent of all recipients of bachelor's degrees in 1968 met high school teaching requirements; nearly 15 percent met elementary school requirements. However, for many reasons, including higher salaries, better working conditions, and preferred locations, not all who have certificates enter teaching. In 1968, about 80 percent who met requirements taught at elementary schools and about 66 percent of those who met requirements taught at high schools. If these trends continue, about 2.7 million new graduates will enter teaching between 1968 and 1980.

All other entrants, the great majority of whom are reentrants, also constitute large numbers of entrants to teaching; in recent years, they have made up about two-fifths of all entrants. If the number of reentries each year through 1980 should continue to be governed by the number of teachers who separated 8 years previously (since the average length of separation is 8 years), more than 1.4 million reentering teachers would be added to supply during this period. Altogether, based on past patterns of entry, the number of persons seeking to enter elementary and secondary teaching would reach about 4.2 million over the 1968–80 period, or an annual average of 350,000 a year—more than three-fourths above requirement needs.

Even with this anticipated improved supply, however, teaching opportunities for both men and women will be very favorable in urban ghettos, rural districts, and other areas offering unfavorable working and living conditions. Also, for subjects such as mathematics and the physical sciences for which the demand in private industry and government is also great. In addition, increased demands are expected for teachers of the mentally retarded or physically handicapped. Further specialized training may qualify many secondary school teachers for positions in vocational and technical schools and in junior colleges, where demand is expected to be especially great in future years.

In addition, the demand-supply situation is likely to be affected by a number of adjustments. For example, as manpower constraints are eased, more communities may introduce or expand kindergartens, nursery schools, and curricula for the physically and mentally handicapped, underprivileged, and the gifted. In addition, as the relative supply improves, educational planners may improve the quality of education by hiring additional teachers to reduce class size. The resulting requirements could be significant. Nevertheless, many potential teachers will have to change their occupation choice and pursue other careers.

*Women.* Women constitute about 85 percent of all kindergarten and elementary schoolteachers and hold almost 50 percent of the teaching positions in the secondary (junior and senior high) schools. Men, however, predominate in supervisory and administrative positions in both public and private schools. In 1968, women made up more than 40 percent of all bachelor's and first professional degrees. They are expected to constitute about the same proportion of all such degrees over the 1968–80 period.

Since 70 percent of all college graduates who enter teaching are women, the changing labor-market in teaching could affect women's opportunities in professional employment.[6] Thus, under present circumstances, many young women who would enter teaching may have to seek other employment.

### College and university teachers

*Employment.* The college teaching faculty in the 1968–69 academic year comprises several major groups. The largest, instructional staff for resident degree-credit courses, totaled 503,000 and included 286,000 full-time and 142,000 part-time teachers at the instructor level or above plus 75,000 graduate students who were employed as assistant instructors, teaching fellows, and teaching assistants. The faculty also included about 101,000 teachers of resident nondegree courses; correspondence, radio, or television instruction; extension work; and short courses.

In 1968, about nine-tenths of all full- and part-time teachers were employed by universities and 4-year colleges; most of the remainder were in 2-year institutions.

In the fall of 1968, resident and extension enrollments exceeded 1.1 million in California and 700,000 in New York. Seven other States had enrollments of from 200,000 to 350,000: Illinois, Texas, Pennsylvania, Michigan, Ohio, Massachusetts, and Florida.

*Projected needs.* Between 1968 and 1980, employment requirements for full-time teachers for degree-credit courses in institutions of higher education are expected to increase 40 percent from 286,000 to 395,000. This 2.7-percent annual rate of growth was slower than was the 6.8-percent experienced during the 1960–68 period.

[6] School teaching constituted two-fifths of all professional and related jobs held by women in 1968.

Enrollments in higher education are the key factors underlying the need for college teaching faculty. During the 12 years from 1968–80, degree-credit enrollments are expected to increase more than 50 percent from 6.9 million to 10.7 million. This represents only 40 percent of the annual rate of growth that occurred in the 1960-68 period. The main factor restricting growth of faculty will be the slow increase in enrollments. In addition, average student-teacher ratios are likely to rise, as public junior and community colleges continue their rapid growth and as technological innovations, such as language laboratories and instructional television, are utilized more widely.

Between 1968 and 1980, about 95,000 college teachers will be needed to replace workers who retire or die and 110,000 will be needed for growth—a total of 205,000.

*Supply-demand.* To meet this demand for new teachers, colleges and universities will draw on record numbers of new graduates having advanced degrees. Projections developed by the U.S. Office of Education indicate a rise of more than 125 percent in Ph. D.'s between 1968 and 1980 and a doubling in master's degrees.

Between 1968 and 1980, earned doctoral degrees are expected to total more than 515,000, three times as many as during the previous 12 years. Despite alternative opportunities in industry and government, an increasing proportion of doctoral recipients have continued in college teaching in recent years. If trends continue, the number of new doctoral recipients entering full-time teaching would total about 275,000 between 1968 and 1980, compared with total projected needs of 205,000 and would, therefore, be adequate to meet manpower needs.

More doctoral recipients relative to requirements for college teachers makes it possible and necessary to focus on providing adequate teacher manpower in all disciplines, and on improving the quality of education at 4-year colleges that fall significantly below the national average in the proportion of faculty holding a Ph. D. degree (about 40 percent in 1968). Among these are included many predominantly Negro colleges and universities.

Because of the rapidly rising number of Ph. D.'s in college teaching, the demand for teachers without Ph. D. degrees is expected to drop sharply in degree-credit programs. However, such teachers should find many opportunities in the expanding nondegree programs and in special fields including extension, mail, and television teaching. Furthermore, junior and community colleges may value teaching and work experience more highly than the research-oriented doctorate.

*Women.* Only about one-fourth of all college and university teachers are women. Women hold fewer than one-tenth of the college teaching positions in engineering and physical sciences, agriculture, and law. However, most teachers in nursing, home economics, and library sciences are women.

### Lawyers

*Employment.* In 1968, the great majority of approximately 270,000 lawyers worked full time. More than 75 percent were in private practice. Over 50 percent of these were in practice by themselves; and about 47 percent were in partnerships or worked for other lawyers or law firms.

The greatest number of salaried attorneys worked for Government agencies. Over 16,000 attorneys were employed by the Federal Government, chiefly in the Departments of Justice, Defense, Treasury, and the Veterans Administration. About 7,500 attorneys were employed by State Government, and 7,600 held positions with city or county governments. Large manufacturing firms, banks, insurance companies, real estate firms, and public utilities also employ lawyers. Most of the remainder teach in law schools.

Although lawyers practice in nearly every city and town in all areas of the country, most are employed in cities and States having the greatest population. Over two-fifths of all lawyers are located in only five States—New York, California, Illinois, Texas, and Ohio.

Many people who have legal training are not employed as lawyers, but are in occupations where they can use their knowledge of the law. For example, insurance adjusters, probation officers, and claim examiners.

*Projected needs.* Over the 1968–80 period, requirements for lawyers are expected to increase from approximately 270,000 to 335,000 or 23 percent. This 1.7 percent annual increase is faster than 1.5 percent experienced over the 1960 to 1968 period.

Increased requirements for lawyers reflect the continuing expansion of business activity and an increasing population. In addition, low- and middle-income groups will use more legal services. For example, expansion of legal services for low-income groups has come about through the Community Action Programs authorized under the Economic Opportunity Act of 1964. The growing complexity of business and government activities are expected to create a steadily expanding demand for lawyers in corporation, patent, administrative, labor and international law.

In addition to manpower needs of 65,000 resulting from increased requirements, about 108,000 lawyers will be required to replace those who die, retire, or otherwise leave the labor force. Manpower needs for both growth and replacement thus are expected to total more than 173,000, an average of 14,500 a year from 1968–80.

*Supply-demand.* A person must be admitted to the bar to practice law. To take the examinations generally required by the States for bar admission, an applicant usually must graduate from an approved law school.

Some States will accept study in a law office instead of, or in combination with, study in a law school. A few States will accept study of the law wholly in a law office; only two States will accept study of the law by correspondence. For supply-demand analysis, however, sources other than law school graduates can be ignored.

In any given year the number of persons passing bar examinations is greater than the number of law school graduates since some graduates delay and others repeat taking bar examinations. However, not all those who pass a bar examination practice law. Based on past relationships between law school graduates, numbers taking and passing bar examinations, and numbers actually entering the occupation, an average of about 20,000 law school graduates would be needed annually over the 1968-80 period to meet projected requirements.

In 1968, almost 17,000 persons received bachelor's or first professional degrees in law. To meet requirements, the average number of law degrees granted annually will have to increase about 20 percent above 1968 levels. Projections developed by the U.S. Office of Education estimate the average number of degrees awarded in law will increase slightly over 20 percent. Thus, the supply of law school graduates should about balance the demand for lawyers based on past patterns of study and entry to the profession.

*Women.* Approximately 8,000 women or about 3 percent of the profession were working as lawyers in 1968. More than 50 percent were employed in salaried positions by government agencies or as law associates for another lawyer or law firm. Only a few were self-employed.

In 1968, approximately 675 women received law degrees. This represents an increase of more than 190 percent over the 230 law degrees granted women in 1960. Over the same period, the total number of law degrees awarded increased approximately 83 percent.

**Architects**

*Employment.* An estimated 34,000 registered (licensed) architects were employed in the United States in 1968. In addition, many other unlicensed architectural graduates were working in positions requiring a knowledge of architecture.

Approximately two-fifths of all architects are self-employed, either practicing individually or as partners. Many work for architectural service firms; some are employed by engineering, building, and real estate firms, as well as for other businesses with large construction programs.

Architects also are employed by government agencies, often in fields such as city planning and urban redevelopment. Approximately 1,500 of these were employed by the Federal Government. About 2,500 architects primarily in teaching positions were employed by colleges and universities.

Though employed in all parts of the country, architects are concentrated in those States with large metropolitan areas. Nearly half of all architects are employed in only six States—California, New York, Illinois, Texas, Pennsylvania, and Ohio.

*Projected needs.* Over the 1968-80 period, employment requirements for architects are expected to increase from 34,000 to 50,000 or 47 percent. This 3.3-percent annual rate of growth is slower than the 1960-68 period, when employment increased an average of 3.4 percent a year.

A major factor contributing to the anticipated increase in requirements for architects is the expected growth in nonresidential construction—the major area of work for architects. Moreover, the increasing size and complexity of modern nonresidential buildings, as well as homeowner's growing awareness of the value of architects' services, are likely to bring about a greater demand for architects.

Urban redevelopment and city and community planning are expected to increase requirements for architects. Expanding college enrollments will create an additional need.

In addition to manpower needs of 16,000 resulting from increased requirements, about 12,000 architects will be required to replace those who die, retire, or leave the labor force for other reasons. Over the 1968-80 period, manpower needs for both growth and replacement are thus expected to total about 28,000, an average of 2,300 a year.

*Supply-demand.* All States and the District of Columbia require a license to practice architecture. Although licensing requirements are set by the individual States, graduation from an accredited professional school is usually required. Most States accept 10 to 12 years' practical experience as a substitute for formal training. Thus, almost the entire number of annual average openings for architects will have to be met from new college graduates receiving degrees in architecture. Not all who receive degrees in architecture, however, become registered architects.

Based on past relationships between graduates and registration, approximately 4,200 architectural graduates would be needed annually to meet projected requirements. In 1968, almost 3,300 bachelor's or first professional degrees were granted in architecture. To meet requirements, therefore, the average number of bachelor's degrees granted annually in architecture over the 1968-80 period will have to be almost 30 percent above 1968 levels. Projections developed by the U.S. Office of Education estimate that the average number of bachelor's degrees will increase by about a third. Thus, the supply of new architectural school graduates should be in rough balance with the demand for registered (licensed) architects based on past patterns of study and entry to the profession.

*Women.* About 4 percent of all registered architects are women. In contrast to all architects, few women are self-employed; most work for architectural service firms and government agencies.

In 1968, 140 women received degrees in architecture. This is an increase of about 145 percent over the 57 architectural degrees awarded women in 1960. Over the same period, the total number of bachelor's degrees awarded in architecture increased about 80 percent.

**Counselors**

*Employment.* More than 70,000 persons were employed in three areas of counseling in 1968: School, rehabilitation, and employment.[7]

*School counselors* represent the largest group. Approximately 54,000 persons did counseling in public secondary schools during the 1968-69 school year. More than 29,000 were full-time counselors. Counseling services in the elementary schools are being steadily expanded; about 5,500 persons worked as counselors at this level in 1968-69.

The majority of counselors are in large schools. An increasing number of school districts, however, are assigning several schools to a counselor.

*Rehabilitation counselors* employment totaled about 12,000 in 1968. About three-fourths were full-time counselors.

About three-fourths of all rehabilitation counselors were employed in State and local agencies financed cooperatively with Federal and State funds. The remainder were employed by hospitals, labor unions, insurance companies, special schools, rehabilitation centers, sheltered workshops, and other public and private agencies conducting rehabilitation programs and providing job placement for the disabled.

*Employment counselors* in State offices in early 1968 totaled about 5,300. They were located in every large city and in many smaller towns. More than four-fifths were employed full-time. The next largest number—probably about 2,000—worked for various private or community agencies offering vocational counseling, primarily in the larger cities. In addition, some worked in prisons, training schools for delinquent youths, and mental hospitals. The Federal Government employed a limited number chiefly in the Bureau of Indian Affairs and the Veterans Administration. Some people trained in employment or vocational counseling do research or graduate teaching.

*Projected needs.* Manpower requirements for schools, rehabilitation, and employment counselors are expected to rise about 50 percent from more than 70,000 in 1968 to more than 105,000 in 1980.

Manpower requirements for school counselors, the largest group, are expected to rise 40 percent from 54,000 to 75,000 between 1968 and 1980. This represents a slower annual rate of growth, 3.2 percent, than the 1961-62 to 1968-69 period, when employment increased an average of 5.8 percent a year.

Continued strengthening of counseling services and some increase in secondary school enrollments underlie the expected rapid growth in requirements for school counselors. Contributing to demand also is the importance of guidance services to help students with personal and social problems remain in school. Employment growth of counselors also will be stimulated by the great numbers of high school students planning to go to college or entering the labor force for the first time. Many will seek advice about rising educational requirements for entry jobs, job changes resulting from automation and other technological advances, and places where employment can be found.

In addition to growth needs of about 21,000, about 23,000 school counselors will be needed to replace workers who die or leave the field because of family responsibilities, or retire.

From 1968 to 1980, employment requirements for rehabilitation counselors are expected to increase almost 75 percent, from 12,000 to 21,000. This 4.7-percent annual rate of growth is only a quarter of the 19.7-percent annual growth rate that occurred from 1961 to 1968.[8]

Factors contributing to the expected very rapid increase in requirements for rehabilitation counselors are population growth and the increased numbers of handicapped persons; extension of services to the severely disabled; increasing support for social welfare; and the growing awareness that expenditures for rehabilitation often are returned as savings on the appropriations for custodial care of health and social welfare programs.

In addition to growth needs of 9,000 rehabilitation counselors, about 4,000 will be needed to replace those who die, retire, or leave the labor force for family responsibilities or other reasons over the 1968-80 period.

Manpower needs for employment counselors, the smallest of the three counseling groups, are expected to more than double between 1968 and 1980 from 5,300 to 10,800. This represents about the same annual rate of growth, 6.1 percent, that occurred over the 1964-68 period.

Among the factors contributing to the expected very rapid growth in requirements for counselors in State employment service offices are three major Federal laws: the Vocational Education Act of 1963, which provides for vocational guidance and counseling for people who are out of school and seeking employment; the

[7] Some people who are identified with other professions including the counseling psychologist and social worker also provide counseling services. Other workers who do some counseling but whose primary work is in teaching, health, law, religion, or other fields, are not included in this discussion.

[8] In recent years the rapid increase in employment growth was stimulated by legislation which expanded and improved rehabilitation services and facilities.

Manpower Development and Training Act of 1962, as amended, which provides for counseling in connection with the occupational training or retraining of large numbers of unemployed workers; and the Economic Opportunity Act of 1964, as amended, which provides for counseling to implement such programs as Job Corps, Neighborhood Youth Corps, Work Training, Work Experience, and Urban and Rural Community Action. State employment service offices also will employ additional counselors to work with returning veterans, older persons, American Indians, and inmates of correctional institutions. Moreover, the population growth and particularly the large number of young workers entering the labor force each year will be reflected in larger numbers seeking vocational counseling.

In addition to the 5,500 needed for the growth of the occupation about 3,100 employment counselors will be needed to replace workers who retire, die, or leave the profession for other reasons over the 1968–80 period.

Thus, growth and replacement needs for school, rehabilitation, and employment counselors are expected to average about 5,500 a year, or total about 65,000 over the 1968–80 period.

However, persons graduating with master's degrees in counseling and guidance, probably will constitute the major portion of new supply of qualified counselors. Supply also will be augmented as experienced counselors reenter the labor force (primarily housewives returning to work when their family responsibilities no longer require their full-time attention). Master's degree recipients from rehabilitation counselor training programs, both in education and psychology, and from counseling psychology programs also will contribute to supply.

Not all who receive master's degrees represent new entrants to the profession. For example, many persons work in counseling positions while taking additional training at college and universities leading to a master's degree. If past trends of entry to the profession continue; and if patterns of reentry of women in counseling follow the reentry patterns of women teachers (specific data are not available for counselors), about 12,000 graduates with master's degrees in counseling and guidance and related fields would be needed annually to meet projected requirements.

In 1967-68, about 8,400 persons received master's degrees in counseling and guidance; another 700 were graduated from M.A. programs in counseling psychology and from education or psychology programs in rehabilitation counselor training. Thus, the average annual output from these programs will have to increase at least by one-third over the 1968–80 period to meet manpower needs.

Separate projections of earned degrees in these specific programs were not developed by the U.S. Office of Education. The average annual total number of master's degrees, however, are expected to increase only about 20 percent over the 1968 level. Thus, unless counseling makes up a greater proportion of total education degrees or unless more persons receiving master's degrees in social work and psychology enter the occupation, supply is expected to continue to fall short of demand.

*Women.* About one-half of all persons employed in high school and employment counseling are women.

Women constituted almost one-half of all master's degree recipients in 1967–68 from programs in counseling and guidance, counseling psychology, and education or psychology programs in rehabilitation counselor training. This number was about one-eighth more than their proportion in 1960–61. Over the 1968–80 period, women are expected to increase slightly their proportion of master's degrees awarded in education and psychology.

**Social scientists**

*Employment.* More than 70,000 people were employed professionally in the basic social sciences in 1968. Overlapping among the basic social sciences are related fields such as business administration, foreign service work, and high school teaching. Determining the exact size of each profession is difficult.

Economists are the largest social science group. In 1968, over two-fifths of all professionally employed social scientists—about 31,000—were economists. This number was more than double the 14,000 historians, the second largest group. Political scientists numbered 11,400; sociologists, 10,000; geographers, 3,900; and anthropologists, 3,000.

The majority of social scientists—about 60 percent in 1968—are employed by colleges and universities. Nonprofit organizations and private industry employed almost 30 percent of all social scientists. The remainder worked for government agencies.

Places of employment differ for the various groups of social scientists. About 50 percent of all economists, for example, are employed by business and industry; only about 25 percent work in colleges and universities, and about 20 percent are employed by government agencies—chiefly Federal. In contrast, over 80 percent of all anthropologists are employed by educational institutions, and less than 5 percent, by Federal Government agencies.

Social scientists can be found in every State. They generally are concentrated, however, in those areas with numerous or large colleges and universities and large concentrations of government employment. The largest group of economists, for example, is in the New York and Washington, D.C. metropolitan areas.

*Projected needs.* Employment requirements for social scientists are expected to increase from over 70,000 to more than 105,000 over the 1968–80 period. Requirements for anthropologists are expected to increase from 3,000 to 4,100; economists from 31,000 to 48,000; geographers from 3,900 to 5,200; historians from

14,000 to 19,000; political scientists from 11,400 to 17,000; and sociologists from 10,000 to 14,000.

This increase of over 45 percent in requirements for all social scientists over the 1968-80 period represents an annual growth rate of 3.2 percent compared with 4.8 percent in the 1960-68 period. Much of the past growth of social scientists, reflecting substantial increases in college enrollments from 1960 to 1968, can be traced to increased requirements by colleges and universities.

The anticipated rise in college teaching will continue to be a major factor contributing to increased employment for social scientists. Government programs concerned with manpower training, unemployment, and the elimination of poverty will increase requirements for social scientists to handle research and administrative functions associated with these programs.

In addition to manpower needs of about 33,000 resulting from anticipated growth in social science professions, almost 25,000 will be needed to replace those who die, retire, or leave the labor force for other reasons. Over the 1968-80 period, manpower needs for both growth and replacement are expected to total about 58,000, an average of 4,800 a year.

*Outlook.* Supply and demand data are lacking for social scientists. However, the small amount available suggests that social scientists having doctor's degrees will find employment opportunities favorable through the 1970's in both teaching and nonteaching. For those having less training, employment will differ among the fields. College graduates with only the bachelor's or master's degree in history, for example, probably will encounter considerable competition as professional historians. On the other hand, opportunities for geographers and economists, for example, holding bachelor's and master's degrees will be more favorable, especially in Federal Government agencies.

Since many social scientists are employed by colleges and universities—where the Ph. D. generally is required—the key factor in the supply of social scientists is the number of Ph. D.'s awarded in appropriate fields. A more detailed discussion of the supply-demand for college teachers is contained elsewhere in the report. (See section on College and University Teachers).

*Women.* About 10 percent of the more than 70,000 social scientists employed in 1968 were women. Among the social science fields, however, the representation of women varied considerably. For example, women constitute 20 percent of all anthropologists, about 5 percent of all economists, about 10 percent of all geographers, and about 15 percent of all sociologists. As with all social scientists, women in this field primarily are employed by colleges and universities, and government agencies.

Proportionally, more women than men are lost to the social sciences in the progression up the academic hierarchy. For example, women received 35 percent of the bachelor's degrees in the social sciences, 23 percent of the master's degrees, and less than 12 percent of the doctorate's in 1968. Increased employment for women as social scientists centers around two factors. First, women must be guided into those social science fields offering the largest number of opportunities. Although women received 35 percent of all bachelor's degrees in the social sciences, they constituted only 10 percent of those awarded in economics. Second, more women who received bachelor's degrees in the social sciences must be encouraged to continue study toward the doctor's degrees.

## Chapter III. Junior College Trained Manpower

The development of an extensive network of community and junior colleges in the United States has been beneficial in many ways. Foremost, community colleges have trained the disadvantaged. Since they make college opportunities available in the community and students unable to meet requirements at 4-year institutions may be admitted, many from low-income families can attend. Also, junior college curriculums are flexible and can develop training for occupations in a relatively short time after a shortage of workers is found in the community.

Many junior colleges offer 2 programs: the transfer or liberal arts program, which provides courses for the first 2 years of a liberal arts college curriculum, and the career preparation program which prepares a student for a specific career upon graduation. Since students graduating from the transfer program are included in the supply-demand analysis of bachelor's degree holders, the discussion here deals with graduates of career preparation programs.

### Career training available

Junior college career-oriented programs fall into three broad categories. The first includes training that has been traditionally offered at junior colleges, but which has been recently expanded to meet changing needs. For example, many junior colleges have offered engineering drafting; now they have expanded the curriculum to provide the advanced technological aspects of engineering technology. The same is true of the health field where increasing emphasis has been placed on areas such as technical laboratory training. Courses available include science and engineering technologies. New programs are developing in marine technology and environmental control technology; public services with new emphasis being placed in many schools on transportation planning and aide occupations; the business and commercial fields which emphasize food service and distribution; the allied health and medical fields; and many others.

The second category includes occupations where postsecondary training had not been necessary but is becoming increasingly desirable, if not required. A good example of this category is the course offered in law enforcement designed to train policemen.

The third category includes the newly developing aide occupations in public services. Much of the programing in this area has been in conjunction with the New Careers program. New Careers aims to recruit the disadvantaged—many without high school diplomas—and to offer both classroom and on-the-job training for teacher aides, welfare aides, and other paraprofessional jobs in public services, and to make possible further advancement in these jobs.

Community colleges function in two aspects of the program. First, some give special courses needed by the trainees. For example, a group of trainee welfare aides may require a psychology course. The junior college provides instruction and space. The course may be the same general course as taught to freshmen but less concentrated. It may be set up specifically for the trainees. Credit often can be applied later toward an associate degree. If the trainee has not completed high school, some junior colleges hold credits until high school is completed.

A second aspect of the junior college participation appears later. New Careers emphasizes further education. Trainees wishing to advance beyond their initial training may work toward an associate or a bachelor's degree.

Courses to ease the shortage of professional manpower have also been developed outside the New Careers program. Should demand continue, a result that may be contingent upon and the availability of Federal funds, the junior college could be an effective training ground for such personnel.

Career education programs vary in length and in awards granted. Most programs are 2 years and lead to the associate degree. A certificate or diploma may be awarded if fewer "general education" courses than required by State law are offered. Some courses range from a few months to a year and offer diplomas or certificates rather than formal degrees. Other courses—especially in the health field—may extend to 3 years if hospital experience is included.

### Development of career education

Between 1958 and 1968, enrollment in community and junior colleges increased about 200 percent, more than twice as fast as degree enrollments in 4-year institutions as table 2 shows. In the 1968-69 academic year, nearly 1,000 junior colleges were in operation in the United States compared with 678 in 1961. About 50 new institutions have opened each year since the 1960's. Originally, most students entering junior colleges

**Table 2. Degree credit enrollments in higher education, 1958–68**
[In thousands]

| Enrollment | 1958 | 1968 | Percent change |
|---|---|---|---|
| Total enrollments . . . . | 3,236 | 6,758 | 108.8 |
| Junior colleges . . . . . | 386 | 1,164 | 201.6 |
| Other higher education . . . . . | 2,851 | 5,595 | 96.2 |

SOURCE: U.S. Office of Education, Projections of Educational Statistics, 1977–78, table 10, p. 18.

transferred to 4-year institutions to work toward the baccalaureate degree. However, during the past 15 years, junior colleges increasingly have emphasized career education. In 1964, about 66 percent of junior college students were in transfer programs. In 1968, the ratio of transfers to career students was approximately 60 to 40, and the percentage appears to be shifting even further.

Available data hamper the measurement of career-oriented programs. Data on choice of programs are collected when students enter but do not reflect shifts in curriculums nor degrees granted. They show only the student's intention upon entry. Many who enter as transfer students and are unsuccessful in liberal arts shift into career education where they often succeed. These students prefer technically oriented programs geared to immediate employment rather than the more theoretical courses required for a bachelor's degree. Counseling can be extremely important to help a student make his original choice and to remain in school.

Students also shift from career oriented programs into transfer programs. A good example is the nursing student who transfers and works for a BS in nursing after studying the first year for an associate degree.

Receiving credit towards a bachelor's degree for work earned in occupational programs may be difficult. However, many universities will accept credit earned by the junior college graduate while he was in a career oriented program. In the future as student mobility increases, "recognition" for course work is expected regardless of the initial program.

## Graduates

The following tabulation shows the number of associated degrees awarded by junior colleges from 1965 to 1968.

| *Academic year* | *Total associated degrees awarded* | *Awards in 2–4 year occupational programs* | *Awards in 1–2 year occupational programs* |
|---|---|---|---|
| 1965–66 . . . . . | 93,687 | 45,378 | 10,377 |
| 1966–67 . . . . . | 119,151 | 73,520 | 14,561 |
| 1967–68 . . . . . | 137,821 | 60,735 | 15,914 |

Many community colleges classify programs, previously considered terminal, as bachelor transfer programs, especially when 4-year training is becoming increasingly available. This tendency explains most of the apparent drop in occupational awards from 1966–67 to 1967–68. For example in collecting 1967–68 data, the Office of Education specified that students in preengineering be excluded for recipients of awards for occupational competence since they are expected to complete their education at the baccalaureate level.

The American Association of Junior Colleges (AAJC) reports that some 78,000 students earned degrees in occupational programs and another 20,000 received certificates for completion of programs for less than 2 years. The AAJC estimates that in 1969 enrollments increased 20 percent, partially as a result of the opening of new colleges. The AAJC figure is larger than that of the Office of Education primarily because the Office of Education data excluded several hundred junior colleges that appear in the AAJC directory.

Occupational programs in junior colleges cannot be measured by the number of graduates alone. Certain factors make such a measure unreliable. For example, some students begin their study in an area in which demand in the community is strong. When on-the-job training is offered elsewhere, they may drop out before completing their education. Another possible measure of growth in career presentation programs is the addition of new courses. An indication of this is the increased number of courses offered by the Vocational Education Act of 1963. Training under this act was increased from 402 community colleges in 1967, 474 in 1968, and 509 in 1969.

In 1968, the largest number of graduates completed business studies. The next largest groups, in order of size, were mechanical and engineering technology, drafting, construction, metallurgy, auto mechanics, electronics, instrumentation, and similar programs. Many others also graduated from medical, dental, library, and law enforcement programs.

## Training and jobs

Information on job placement of junior college graduates is scarce. However, since junior colleges are usually local and draw both student and financial support from a very small area, their programs are designed to fit the community. Therefore, career programs tend to be formulated around manpower requirements of the local area. As a result students generally have little difficulty in job placement.

One nationwide study of 2-year technology graduates indicated success both in finding jobs and in furthering students' education. The known status of over 10,000 from a total group of 12,046 indicates the following:

63 percent were employed
23 percent were continuing full-time study
6 percent were entering military services
6 percent were considering job offers
1 percent had other specific plans

## Chapter IV. Analysis of Supply-Demand in Selected Occupations Generally Requiring Junior College Training for Entry

The following statements on specific occupations are presented to indicate the employment situation in some occupational areas where junior colleges provide training. The list is by no means comprehensive, and the data are not inclusive. These statements do, however, serve as an example of the wide range of courses of study available and the contribution of junior college graduates to the supply of workers needed to fill manpower requirements over the next decade.

### Engineering and science technicians

*Employment.* Approximately 970,000 engineering and science technicians were employed in 1968. About 740,000, or more than 7 out of 10, were employed in private industry, primarily in the electrical equipment, machinery, chemical, and aerospace industries. In the nonmanufacturing sector, the largest employers of these technicians were the communications industry and engineering and architectural firms.

In 1968, the Federal Government employed over 90,000 engineering and science technicians. The majority worked for the Department of Defense; most of the remainder in the Federal Government were employed by the Departments of Agriculture, Commerce, and the Interior.

About 60,000 engineering and science technicians worked for State governments; more than 25,000 were employed by local governments. Most of the remainder were in colleges and universities, primarily in university operated research institutes and nonprofit organizations.

*Growth.* Employment requirements for engineering and science technicians are expected to reach 1.4 million by 1980, an increase of almost 45 percent above the 1968 levels, or an average of 3.1 percent a year.

Among the factors underlying the increase in demand for technicians are the anticipated expansion of industry and the increasing complexity of modern technology—changes resulting in an increasing need for technicians, especially in production planning and technical sales work. Furthermore, as the employment of scientists and engineers continues to grow, increasing numbers of technicians will be needed to assist them. The trend toward automation of industrial processes and the growth of new areas of work, such as that related to space exploration or atomic energy, also will add to the demand for technical personnel.

In addition to manpower needs of over 425,000 to fill new positions, about 170,000 will be needed to replace those who die and retire and about 430,000 will be needed to replace those who transfer to other occupations. Manpower needs for growth and replacement are then expected to total about 1 million for the 1968-80 period, an average of almost 86,000 a year.

*Source of new entrants.* The skills necessary to enter technician jobs may be gained in a variety of ways. One way is through training taken expressly to prepare and qualify for entry level technician jobs—"preemployment occupational training." This training is offered by post-secondary schools including junior colleges; employers; and government.

Other workers qualify for technician jobs through training designed primarily for some other purpose including training and/or experience in Armed Forces technical work, and in bachelor's degree programs in engineering or science. Another way to qualify for technician work is through "upgrading"—experience in a technician related job, often combined with some academic training. Upgradings have been the largest single source of new entrants to technician jobs in recent years. Preemployment post-secondary school training, however, provides the technicians who generally are in greatest demand, according to information gathered by BLS representatives in interviews with officials of companies employing large numbers of technicians. Also, this source of supply has grown most rapidly; entrants increased from about 9,000 in 1960 to over 35,000 in 1968.[9]

The future supply-demand conditions for technicians will depend on the expansion of preemployment post-secondary training offered primarily in junior colleges. The efforts underlying the rapid expansion of experience during the 1960's must continue through the 1970's if future manpower requirements for technicians are to be filled with highly trained workers.

*Women.* About 11 percent of all science and engineering

[9]Entrants represent about two-thirds of graduates because many graduates continue in school or enter other occupations.

technicians in 1968 were women. The proportion of women varies considerably by occupation within the science and engineering field, the largest percentage—about 25 percent—were employed as life science technicians.

**Forestry aids**

*Employment.* An estimated 13,000 persons were employed as forestry aids in 1968. About 5,000 were employed by the Federal Government, mainly by the Forest Service of the U.S. Department of Agriculture. Approximately 2,000 were working for State governments. About 6,000 were employed in private industry, primarily by lumber, logging, and paper milling companies. Forestry aids also worked in tree nurseries and in forestation projects of mining, railroad, and oil companies.

Most forestry aids are employed in the heavily forested States of Washington, California, Oregon, Idaho, Utah, and Montana.

*Growth.* Employment requirements for forestry aids are expected to reach nearly 20,000 by 1980, an increase of about 57 percent above the 13,000 employed in 1968.

Growth in demand is expected to accompany the rising employment of foresters. In addition, employers are expected to increasingly use aids to assume routine jobs now done by foresters. Growth in government employment will stem from factors such as increasing demand for recreational facilities, more scientific management of forest land and water supplies, and the increased timber cutting on Federal forest land.

In addition to the 7,000 forestry aids expected to be needed to fill openings caused by growth in employment over the 1968-80 period, another 3,000 will be needed to replace those who die, retire, and leave the occupation for other reasons.

*Sources of new entrants.* Persons qualify for beginning positions as forestry aids either by completing a specialized 1- or 2-year post-secondary school curriculum or through work experience.

To meet projected needs for 10,000 forestry aids over the next 12 years—7,000 for growth and 3,000 for replacement—over 800 persons must enter the field each year. In 1968, 564 persons graduated from less-than-4 year programs in forestry. To fill needs primarily with trained workers, the annual number of graduates of these forestry aid curriculums should expand at least 50 percent above the 1968 level.

*Women.* Although statistics are not available, it is estimated that few women are employed in this occupation which requires a great deal of heavy work in all weather conditions often in remote areas.

**Dental assistants**

*Employment.* Nearly 100,000 persons were employed as dental assistants in 1968; about 1 out of 5 were employed part time. Most dental assistants worked in private dental offices, either for individual dentists or for groups of dentists. Many of the remainder were employed in dental schools, hospital dental departments, State and local public health departments, or private clinics. The Federal Government employed about 2,000 dental assistants in 1968.

By 1980, employment requirements for dental assistants may reach about 150,000, an increase of 50 percent above 1968 levels. This represents a more rapid growth rate, 4.2 percent, than in the 1960-68 period when employment increased by an average of 2.6 percent a year.

Growing awareness of the importance of regular dental care and the increasing ability of persons to pay for care are among the factors underlying an anticipated rapid growth in the demand for the services of dental assistants. Other factors affecting demand are an increased participation in dental prepayment plans, and the expansion of public programs such as Medicaid and Head Start. The slow increase in the supply of dentists in proportion to population growth will result in greater use of auxiliary workers.

In addition to manpower needs of 50,000 resulting from the rapid growth of the occupation, more than 54,000 assistants will be needed to replace workers who will retire, die, and leave the occupation for other reasons during the 1968-80 period.

*Sources of new entrants.* Most dental assistants employed in 1968 had learned their skill on the job. In recent years, however, an increasing number have studied in formal post-secondary dental assisting programs.

To meet the projected need for 104,000 dental assistants—50,000 for growth and 54,000 for replacements—an average of 8,500 persons would have to enter the occupation each year during the 1960-68 period. In 1968, fewer than 2,000 persons graduated from post-secondary training programs. Thus, the average number of graduates of these programs could be expanded fourfold through the 1970's without ever meeting all requirements with academically trained workers.

*Women.* Almost all dental assistants are women. The few men in the occupation are serving in the Armed Forces.

**Dental hygienists**

*Employment.* Approximately 16,000 dental hygienists were employed in 1968. Many worked part time. The majority of all dental hygienists were employed in private dental offices; others worked for public health agencies, school systems, industrial plants, clinics, hospitals, dental hygiene schools, and as civilian employees of the Armed Forces.

*Growth.* By 1980, employment requirements for dental hygienists are expected to reach 33,500, an increase of about 109 percent above the 16,000 employed in 1968. This represents a faster average annual rate of growth, 9.1 percent than in the 1960 period, when employment increased by an average of 2.4 percent a year.

The demand for hygienists is expected to increase as a result of the expanding population and the growing awareness of the importance of regular dental care. Increasing interest in dental care programs for children also will expand employment. Increased participation in dental prepayment plans and more group practice which enable expense sharing by dentists also should result in more jobs for dental hygienists.

In addition to the approximately 13,500 dental hygienists expected to be needed to fill openings caused by growth in employment, another 20,000 will be needed to replace those who retire, die, and leave the labor force for other reasons between 1968 and 1980. From 1968 to 1980, manpower needs for both growth and replacement thus are expected to total about 33,500, an average of 2,800 a year.

*Sources of new entrants.* Most new entrants in dental hygiene obtain certificates or associate degrees in dental hygiene through formal 2-year programs offered in post-secondary schools. A much smaller number are graduates of 4-year bachelor's degrees programs. In addition, many will reenter the occupation after a period outside the labor force, primarily women returning to work when family responsibilities do not require their full attention.

In 1968, a total of 1,555 dental hygienists graduated from less than 4-year programs. After allowance for entrants that can be expected from sources other than new graduates of 2-year programs, significant expansion of these programs would be needed to meet manpower needs.

*Women.* Virtually all dental hygienists are women and data on graduates indicate that this will continue.

**Radiologic technologists**

*Employment.* An estimated 75,000 radiologic technologists were employed in 1968. Approximately one-third of all radiologic technologists were employed in hospitals; most of the remainder worked in medical laboratories, physicians' and dentists' offices or clinics, Federal and State health agencies, and public school systems. A few were members of mobile X-ray teams, engaged mainly in tuberculosis detection.

*Growth.* By 1980, employment requirements for radiologic technologists are expected to reach 120,000, an increase of about 60 percent over the 75,000 employed in 1968.

The very rapid rate of growth in employment of radiologic technologists is expected primarily as a result of the anticipated expansion in the use of X-ray equipment in diagnosing and treating diseases. More workers also will be needed to help administer radiotherapy, as new knowledge of the medical benefits of radioactive material becomes widespread. X-raying of large groups of people will be extended as part of disease prevention and control programs.

In addition to the technologists needed for new jobs, replacement demands will total about 40,000 between 1968 and 1980. Manpower needs for both growth and replacement are thus expected to total more than 85,000, an average of 7,000 a year.

*Sources of new entrants.* Training programs in X-ray technology conducted by hospitals or medical schools affiliated with hospitals are the primary source of entrants to radiologic technology each year. Most of these programs are of 2 years' duration, although some 3- and 4-year programs are offered. Junior colleges offer academic training coordinated with work experience in hospitals in 3-year X-ray technician programs. In addition to these entrants, others are trained in the Armed Forces and some women reenter after being out of the labor force because of family responsibilities. In 1967, the latest year for which data are available, 3,827 graduated from X-ray technology programs. To meet anticipated manpower needs of 7,000 openings a year over the 1968 period, trends in the number of graduates indicate that they can be expected to fall short of these requirements.

*Women.* About two-thirds of all radiologic technologists are women, and trends indicate that the ratio is likely to remain fairly stable.

**Library technicians**

*Employment.* An estimated 70,000 library technicians were employed in 1968. Most technicians were employed in public and school libraries. Smaller numbers worked in college and university libraries, and in business, medical, and other special libraries. The Federal Government employed about 3,000 library technicians in 1968.

*Growth.* By 1980, employment requirements for library technicians are expected to reach 124,000, an increase of 77 percent above the 70,000 employed in 1968. The increasing demands of a growing population for library services and the continuing shortages of professional librarians are among the chief factors underlying an expected very rapid growth in employment requirements for library technicians.

Besides the technicians for new positions, about 24,000 library technicians will be needed over the 1968-80 period to replace those who die, retire, or leave the field for other reasons. Manpower needs are

therefore, expected to total 78,000, an average of 6,500 a year, for the 1968-80 period.

*Sources of new entrants.* Although most library technicians employed in 1968 were trained on the job, the number receiving training in formal post-secondary programs is continually increasing. In the future, most employers may require such training.

In 1968, only 107 persons graduated from less than 4 year programs in technical library work. Thus, such programs could expand enormously over the next 12 years and still fall short of the annual needs of 6,500 library technicians.

*Women.* In 1968, about 70 percent of all library technicians were women. However, limited data indicate that the proportion of men in the profession is increasing.

**Police officers**

*Employment.* An estimated 285,000 full-time policemen and policewomen were employed in 1968 by local government police departments. Policemen are concentrated in large cities although they are employed in virtually every city and town in the country. The forces upon which they work vary in size from over 31,000 officers to fewer than 25.

*Growth.* By 1980, employment requirements for police officers are expected to reach 360,000, an increase of more than 27 percent over the 285,000 employed in 1968.

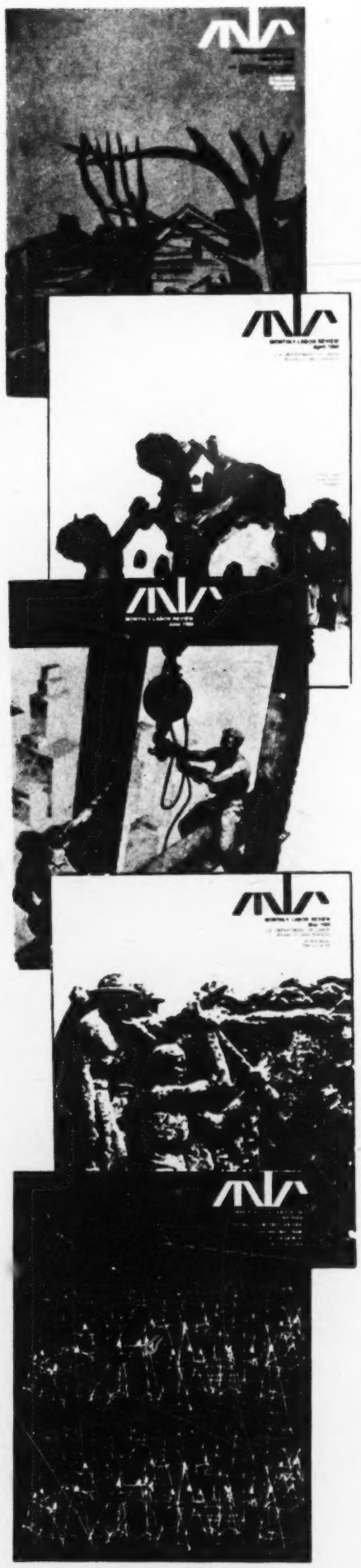
Employment of police officers is expected to grow as cities increase the size of their police forces to meet needs of a growing population, including traffic control as the number of motor vehicles continues to increase.

In addition to the more than 75,000 police officers to fill new positions over the 1968-80 period, nearly 100,000 will be needed to replace those who die, retire, and leave the occupation for other reasons.

*Sources of new entrants.* Most police departments require a high school diploma as a requisite for obtaining a job. Some cities require some college training, and some hire law enforcement students as police interns. Since police departments are emphasizing post-high school training in subjects such as sociology, psychology, and minority group relations, more police officers probably will be recruited from post-secondary training in the future.

During the next 12 years, annual openings will average close to 15,000. In 1968, 1,840 persons graduated from programs of less than 4 year duration. This number will have to expand rapidly to keep pace with the demand for policemen with special law enforcement training.

*Women.* About 5 percent of all police officers are women. Almost all are employed by large city police departments, where their work frequently involves handling cases dealing with juveniles and women.



**Q** What do these men and women have in common?

management officials · union leaders · librarians · legislators · educators · government officials · business representatives · personnel managers · labor reporters · business editors · attorneys · arbitrators

**A** They all depend on the authoritative articles, reports, and statistical tables available exclusively in the Monthly Labor Review.

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